Claims

1. An optical recording medium comprising:

a substrate;

an optically transparent layer;

a first dielectric layer;

a noble metal oxide layer;

a second dielectric layer;

a light absorbing layer; and

a third dielectric layer,

said first dielectric layer, said noble metal oxide layer, said second dielectric layer, said light absorbing layer and said third dielectric layer being disposed between said optically transparent layer and said substrate in this order in view from said optically transparent layer,

wherein setting is done so that λ/NA is not longer than 640 nm when λ designates a wavelength of a laser beam and NA designates a numerical aperture of an objective lens for focusing said laser beam, and setting is done as:

$$Pw \times 0.1 \leq Pr \leq Pw \times 0.5$$

when Pw designates recording power of said laser beam and Pr designates reproducing power of said laser beam, while said optical recording medium includes setting information required for recording a recording mark train including recording marks each having a length not larger than $\lambda/4NA$ and for reproducing data from said recording mark train.

2. An optical recording medium comprising:

a substrate;

an optically transparent layer;

a first dielectric layer;

a noble metal oxide layer;

a second dielectric layer;

a light absorbing layer; and

a third dielectric layer,

said first dielectric layer, said noble metal oxide layer, said second dielectric layer, said light absorbing layer and said third dielectric layer being disposed between said optically transparent layer and said substrate in this order in view from said optically transparent layer,

wherein setting is done so that λ/NA is not longer than 640 nm and recording power of a laser beam is not lower than 5.3 mW and not higher than 11.0 mW when λ designates a wavelength of said laser beam and NA designates a numerical aperture of an objective lens for focusing said laser beam, while said optical recording medium includes setting information required for recording a recording mark train including recording marks each having a length not larger than λ/4NA.

3. An optical recording medium comprising:

a substrate;

an optically transparent layer;

a first dielectric layer;

a noble metal oxide layer;

a second dielectric layer;

a light absorbing layer; and

a third dielectric layer,

said first dielectric layer, said noble metal oxide layer, said second dielectric layer, said light absorbing layer and said third dielectric layer being disposed between said optically transparent layer and said substrate in this order in view from said optically transparent layer,

wherein setting is done so that λ/NA is not longer than 640 nm and reproducing power of a laser beam is not lower than 1.1 mW and not higher than 3.3 mW when λ designates a wavelength of said laser beam and NA designates a numerical aperture of an objective lens for focusing said laser beam, while said optical recording medium includes setting information required for reproducing data from a recording mark train including recording marks each having a length not larger than λ/4NA.

4. An optical recording medium according to any one of Claims 1 through 3, characterized in that said substrate is not thinner than 0.6 mm and not thicker than 2.0 mm, said optically transparent layer is not thinner than 10 μm and not thicker than 200 μm, said noble metal oxide layer is not thinner than 2 nm and not thicker than 50 nm, said second dielectric layer is not thinner than 5 nm and not thicker than 100 nm, said light absorbing layer is not thinner than 5 nm and not thicker than 100 nm, and said third dielectric layer is not thinner than 10 nm and not thicker than 140 nm.

5. An optical recording medium according to any one of Claims 1 through 4, characterized in that platinum oxide (PtOx) is included in said noble metal oxide layer.

6. An optical recording medium according to any one of Claims 1 through 5, characterized by further comprising a reflecting layer provided between said substrate and said third dielectric layer.

7. An optical recording/reproducing apparatus for recording and reproducing data into and from an optical recording medium by irradiating said optical recording medium with a laser beam from an optically transparent layer side, said optical recording medium having a substrate, an optically transparent layer, a first dielectric layer, a noble metal oxide layer, a second dielectric layer, a light absorbing layer and a third dielectric layer, said first dielectric layer, said noble metal oxide layer, said second dielectric layer, said light absorbing layer and said third dielectric layer being disposed between said optically transparent layer and said substrate in this order in view from said optically transparent layer, said optical recording/reproducing apparatus being characterized in that: setting is done so that λ/NA is not longer than 640 nm when λ designates a wavelength of said laser beam and NA designates a numerical aperture of an objective lens for focusing said laser beam, and setting is done as $Pw \times 0.1 \leq Pr \leq Pw \times 0.5$ when Pw designates recording power of said laser beam and Pr designates reproducing power of said laser beam, while said optical recording/reproducing apparatus records a recording mark train including recording marks each having a length not larger than $\lambda/4NA$ and reproduces data from said recording mark train.

8. An optical recording apparatus for recording data into an optical recording medium by irradiating said optical recording medium with a laser beam from an optically transparent layer side, said optical recording medium having a substrate, an optically transparent layer, a first dielectric layer, a noble metal oxide layer, a second dielectric layer, a light absorbing layer and a third dielectric layer, said first dielectric layer, said noble metal oxide layer, said second dielectric layer, said light absorbing layer and said third dielectric layer being disposed between said optically transparent layer and said substrate in this order in view from said optically transparent layer, said optical recording apparatus being characterized in that: setting is done so that λ/NA is not longer than 640 nm and recording power of said laser beam is not lower than 5.3 mW and not higher than 11.0 mW when λ designates a wavelength of said laser beam and NA designates a numerical aperture of an objective lens for focusing said laser beam, while said optical recording apparatus records a recording mark train including recording marks each having a length not larger than λ/4NA.

9. An optical reproducing apparatus for reproducing data from an optical recording medium by irradiating said optical recording medium with a laser beam from an optically transparent layer side, said optical recording medium having a substrate, an optically transparent layer, a first dielectric layer, a noble metal oxide layer, a second dielectric layer, a light absorbing layer and a third dielectric layer, said first dielectric layer, said noble metal oxide layer, said second dielectric layer, said light absorbing layer and said third dielectric layer being disposed between said optically transparent layer and said substrate in this order in view from said optically transparent layer, said optical reproducing apparatus being characterized in that: setting is done so that λ/NA is not longer than 640 nm and reproducing power of said laser beam is not lower than 1.1 mW and not higher than 3.3 mW when λ designates a wavelength of said laser beam and NA designates a numerical aperture of an objective lens for focusing said laser beam, while said optical reproducing apparatus reproduces data from a recording mark train including recording marks each having a length not larger than λ/4NA.

10. A data recording/reproducing method for recording and reproducing data into and from an optical recording medium by irradiating said optical recording medium with a laser beam from an optically transparent layer side, said optical recording medium having a substrate, an optically transparent layer, a first dielectric layer, a noble metal oxide layer, a second dielectric layer, a light absorbing layer and a third dielectric layer, said first dielectric layer, said noble metal oxide layer, said second dielectric layer, said light absorbing layer and said third dielectric layer being disposed between said optically transparent layer and said substrate in this order in view from said optically transparent layer, said data recording/reproducing method being characterized in that: setting is done so that λ/NA is not longer than 640 nm when λ designates a wavelength of said laser beam and NA designates a numerical aperture of an objective lens for focusing said laser beam, and setting is done as $Pw \times 0.1 \leq Pr \leq Pw \times 0.5$ when Pw designates recording power of said laser beam and Pr designates reproducing power of said laser beam, while said data recording/reproducing method records a recording mark train including recording marks each having a length not larger than $\lambda/4NA$ and reproduces data from said recording mark train.

11. A data recording method for recording data into an optical recording medium by irradiating said optical recording medium with a laser beam from an optically transparent layer side, the optical recording medium having a substrate, an optically transparent layer, a first dielectric layer, a noble metal oxide layer, a second dielectric layer, a light absorbing layer and a third dielectric layer, said first dielectric layer, said noble metal oxide layer, said second dielectric layer, said light absorbing layer and said third dielectric layer being disposed between said optically transparent layer and said substrate in this order in view from said optically transparent layer, said data recording method being characterized in that: setting is done so that λ/NA is not longer than 640 nm and a value of recording power of said laser beam is not lower than 5.3 mW and not higher than 11.0 mW when λ designates a wavelength of said laser beam and NA designates a numerical aperture of an objective lens for focusing said laser beam, while said data recording method records a recording mark train including recording marks each having a length not larger than $\lambda/4NA$.

12. A data recording method according to Claim 11, characterized in that said value of said recording power is set to be at least 0.5 mW and at most 2.0 mW higher than a value of recording power with which a carrier/noise ratio will be substantially saturated.

13. A data reproducing method for reproducing data from an optical recording medium by irradiating said optical recording medium with a laser beam from an optically transparent layer side, said optical recording medium having a substrate, an optically transparent layer, a first dielectric layer, a noble metal oxide layer, a second dielectric layer, a light absorbing layer and a third dielectric layer, said first dielectric layer, said noble metal oxide layer, said second dielectric layer, said light absorbing layer and said third dielectric layer being disposed between said optically transparent layer and said substrate in this order in view from said optically transparent layer, said data reproducing method being characterized in that: setting is done so that λ/NA is not longer than 640 nm and a value of reproducing power of said laser beam is not lower than 1.1 mW and not higher than 3.3 mW when λ designates a wavelength of said laser beam and NA designates a numerical aperture of an objective lens for focusing said laser beam, while said data reproducing method reproduces data from a recording mark train including recording marks each having a length not larger than λ/4NA.

14. A data reproducing method according to Claim 13, characterized in that said value of said reproducing power is set to be at least 0.1 mW and at most 0.3 mW higher than a value of reproducing power with which a carrier/noise ratio will be substantially saturated.